

Screening for tuberculosis in chronic kidney disease patients

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Tuberculosis (TB) is the leading infectious cause of morbidity and mortality globally.¹ Singapore is considered a lower-moderate incidence country (estimated TB incidence at 10–49 per 100,000 population); yet TB remains a persistent public health challenge driven by an ageing population and the burden of TB infection.^{2,3} This challenge is compounded by intersecting risk factors and syndemics, including chronic conditions such as diabetes and chronic kidney disease (CKD), which are increasingly prevalent in ageing populations. Globally, CKD affects approximately 14% of adults, and its prevalence is rising, including in Singapore where rates are among the highest in the region.⁴ People with CKD have a significantly elevated risk of TB due to impaired immunity and increased opportunity for infectious exposures during frequent medical visits.⁵

Metussin et al. estimated that TB incidence among CKD patients (279–630 per 100,000 population) was significantly higher than that of the general population (32.6–41.1 per 100,000 population) in Singapore.⁶ The study identified older age, male sex, dialysis treatment, history of smoking and coexisting diabetes as key risk factors for TB among CKD patients. These findings raise questions on who, what and when to screen, and how to align practice with international and local guidance.

The World Health Organization (WHO) recommends that in settings where the TB prevalence in the general population is 100 per 100,000 population or higher, systematic screening for TB disease may be considered for individuals with risk factors, who are seeking or already receiving healthcare.⁷ In Singapore, universal screening for TB among dialysis patients is recommended in the updated TB management guidelines.⁸ Yet, translating recommendations into routine practice can be uneven. Across the Western Pacific Region, several high TB burden countries have policies for systematic screening of dialysis patients, but implementation varies—often limited by funding, workforce and infrastructure.⁹ In Singapore, screening

incident dialysis patients for TB is not regularly performed. Anecdotally, only one institution performs universal screening introduced during the COVID-19 pandemic as a quality improvement measure to reduce “noise” by placing incident dialysis patients with respiratory symptoms out to ambulatory satellite dialysis centres. Given the elevated TB risk among CKD and dialysis patients, more proactive screening for TB disease is warranted. WHO guidance supports the use of symptom screening, chest X-ray or molecular diagnostics in high-risk groups.⁷ At a minimum, CKD patients should be screened for TB disease before initiating dialysis in line with national guidelines.⁸ A more comprehensive approach would ideally include screening for both TB disease and TB infection,⁵ but further evaluation is needed to determine the optimal screening frequency, implementation strategies and cost-effectiveness. Integrating standardised symptom checks and chest X-rays (including routine review of radiographs taken for other clinical reasons) into dialysis workflows could be considered to improve early detection and reduce the risk of transmission in dialysis facilities.

While Metussin et al. did not measure the prevalence of TB infection among CKD patients, a systematic review has shown a high TB infection rate in CKD, particularly in haemodialysis cohorts.¹⁰ A healthy individual with TB infection has a 5–10% chance of progressing to TB, and the risk increases among immunosuppressed populations. This strengthens the case for targeted TB infection testing and TPT before dialysis or transplant.¹¹ Some argue that universal screening for TB in dialysis patients is not cost-effective due to the competing risk of death in dialysis patients.¹² The upfront cost of testing and treatment for TB infection to prevent a TB case is added to the dialysis programme. Moreover, the benefits of treating TB infection accrue with increasing survival time. It is uncertain what cost-effectiveness data are available for a Singapore incident dialysis cohort. However, universal screening may be needed for

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infection control in ambulatory satellite dialysis centres where the same patients regularly meet.

Assuming a base case of 3000 patients per year and a TB incidence of 406 per 100,000 person-years (with TB infection prevalence of 15%), the expected person-years over 5 years is 11,465. Interferon-gamma release assay (IGRA) test (QFT-G [QIAGEN, Hilden, Germany]) was costed at S\$72 (US\$57) per test, TB infection treatment at S\$72 (US\$57) per case for a 6-month isoniazid, or INH treatment, and drug-sensitive TB treatment at S\$15,000 (US\$11,852) per person.¹³ Societal costs including contact tracing were valued at S\$800 (US\$632) per TB case.¹⁴ Five-year survival among dialysis patients was estimated at 56.9%.¹²

Over 5 years, the expected baseline burden without screening is 46.5 TB cases. Considering a baseline of 46.5 TB cases over 5 years without screening and IGRA tests positive in 437 cases (true 360, false 77), screening will avert 2.57 cases in 5 years. Under universal screening, 437 individuals would test IGRA-positive (360 true positives and 77 false positives), compared with 145.67 positives under targeted screening. Based on fixed effectiveness estimates, screening would avert approximately 2.57 TB cases over 5 years.

The 5-year programme's cost for universal screening is S\$192,936.96 (US\$152,455.47), comprising S\$172,800 (US\$136,534) for testing (assuming 80% screening adherence) and S\$20,136.96 (US\$15,911.44) for latent TB infection treatment (assuming 64% treatment uptake). Costs avoided from averted TB cases total S\$40,532.01 (US\$32,024.95), incorporating both healthcare and societal savings. This results in a net programme cost of S\$132,267.99 (US\$104,512.58) and an incremental cost-effectiveness ratio (ICER) of S\$51,466.14 (US\$40,743.94) per TB case averted. The ICER could be reduced to approximately S\$6,641.24 (US\$5,248.04) if a targeted strategy is employed, screening only 1000 patients at the highest risk per year (e.g. males, ex- or current smokers, people with diabetes and Malay ethnicity). The ICER can be reduced below the S\$50,000 (US\$39,512) threshold for universal screening and less than S\$118.35 (US\$93.53) for higher-risk targeted screening if the IGRA test costs less than S\$45 (US\$36).

Importantly, if Singapore's broader TB control strategy is to eliminate TB, a longer time horizon is required, during which higher upfront costs may be acceptable to achieve long-term reductions in transmission. This highlights the need for more detailed modelling of programme costs and the projected long-term impact on TB prevalence in Singapore.

TB control in Singapore is making steady progress, but disproportionate risk among specific populations,

such as those with CKD, means that a one-size-fits-all approach will fall short. Metussin et al.'s findings⁶ reinforce the need to systematically screen CKD populations and expand preventive treatment to those most at risk, aligning practice with WHO recommendations and updated Singapore guidelines. However, universal screening at current prices of screening using IGRA and the ambulatory treatment cost of drug-sensitive TB is likely not cost-effective. A targeted approach for higher-risk patients with longer life expectancy is more likely to offer better value. Nevertheless, further analyses that account for potential cost changes and the long-term impact of systematically screening CKD and dialysis patients for TB in Singapore are needed.

Ethics statement

Not applicable.

Declaration

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